Information needs of rural health professionals: a review of the literature

By Josephine L. Dorsch, M.A.L.S., AHIP
Associate Professor

Health Sciences Librarian
Library of the Health Sciences (Peoria)

University of Illinois at Chicago
College of Medicine at Peoria
P.O. Box 1649, One Illini Drive
Peoria, Illinois 61656
jod@uic.edu

This review analyzes the existing research on the information needs of rural health professionals and relates it to the broader information-needs literature to establish whether the information needs of rural health professionals differ from those of other health professionals. The analysis of these studies indicates that rural health practitioners appear to have the same basic needs for patient-care information as their urban counterparts, and that both groups rely on colleagues and personal libraries as their main sources of information. Rural practitioners, however, tend to make less use of journals and online databases and ask fewer clinical questions; a difference that correlates with geographic and demographic factors. Rural practitioners experience pronounced barriers to information access including lack of time, isolation, inadequate library access, lack of equipment, lack of skills, costs, and inadequate Internet infrastructure. Outreach efforts to this group of underserved health professionals must be sustained to achieve equity in information access and to change information-seeking behaviors.

INTRODUCTION

Published studies of the information needs of health professionals span a wide range of purposes, methodologies, and populations. The needs of physicians have been studied more thoroughly than those of nurses, dentists, pharmacists, or other allied health practitioners. This area of investigation is complicated by various definitions of an information need and the plethora of new resources, points of access, and technologies. Some common threads, however, are evident for all health professionals: information is underused; barriers to information use are significant; and reliance on colleagues and personal libraries over bibliographic sources to satisfy information needs is preferred. Rural health professionals have a number of additional information issues: isolation, lack of library services, and inadequate access to information. The purpose of this review is to analyze the research on the information needs of rural health professionals, relate it to the broader information-needs literature, and determine whether the information needs of rural health professionals differ from those of other health professionals.

BACKGROUND STUDIES

The 1995 American College of Physicians' study of rural primary care found that most rural physicians are in primary care specialties [1]. In addition, data from the American Academy of Family Physicians showed that 44.8% of family physicians were located in communities of less than 25,000 [2]. Given these facts, the results of any study of primary care health practitioners might be applicable to rural practitioners. A common finding in the information-needs literature was the reliance on colleagues and personal journal collections in rankings of information source preferences. Although primary care physicians reported heavy reliance on the literature for medical information, some evidence contradicted their claims. Connelly observed that family physicians in community practice most frequently used *The Physicians Desk Reference* followed by consultation with colleagues to answer clinical questions. The least used sources of information were *Index Medicus* and computer-based indexes, which physicians perceived as inaccessible and not directly applicable to clinical practice. Using a utility-cost model,

Connelly attributed this low use of literature searches to how physicians balance the time and costs against the potential benefits of seeking knowledge [3]. Connelly concluded that even if indexing systems were more convenient, they would still not be highly used by physicians due to the poor clinical applicability, credibility, and comprehensibility of the target information for answering patient-specific questions. Connelly's conclusion was disputed by Gorman et al., who determined from physician feedback on online searches that 56% of clinicians judged the material relevant; 46% said the information provided a clear answer to their question; and 40% expected the information would have an impact on their patient-care decisions [4].

Covell's study of forty-seven internists tracked information needs in office practice [5]. The self-reports indicated that only 30% of physicians' information needs were met during the patient visit, usually by another physician or health professional. Reasons for not using print resources included outdated textbooks and disorganized journals in the office, lack of knowledge of sources, and lack of time to search and retrieve information. Williamson referred to these findings as a preference for human sources rather than paper sources [6]. Of primary care physician respondents (N = 432) in Williamson's study, 63.1% said they would discuss a decision to adopt a clinical advance with a colleague, whereas only 17.5% would conduct a literature search to obtain more information. In addition, according to Williamson, health professionals had an inability to judge the scientific soundness of medical information. Williamson reported that 90% of practitioners compared the findings in the literature to their own experience rather than appraised the findings based on study methodology and statistical significance.

Although fewer in number, studies of health professionals other than physicians generally show the same preference to go to colleagues and personal journal collections. In Spath and Buttlar's study of acute-care clinical nurses, discussion with colleagues was the top way to identify and access information [7]. Dentists likewise expressed a preference for professional colleagues and personal journal collections as sources of information [8]. Responses of physical therapists in private practice showed frequent reliance on personal and office collections of professional literature and virtually no use of bibliographic databases [9].

METHODS

For the purposes of this review, the definition of ''information need'' is limited primarily to knowledge needed for the health professional to carry out patient care and professional duties. Forsythe et al. discuss the meaning of information need, but concede the operational definition of the term generally to be knowledge of and access to information of two kinds: bibliographic information and formal facts such as those found in textbooks and databases [10]. The definition excludes other sources of information such as medical records or diagnostic test data.

Publications for this review of information needs of rural health professionals have been selected if they meet each of the following criteria:

- collected original data
- measured health professionals' use, behaviors, or patterns in seeking information
- included rural health professionals in the study population (in part or whole)
- were published after 1975
- defined information as a knowledge need rather than a need for patient chart or diagnostic test data

A framework composed of four evaluative criteria has been used to classify the articles that meet the selection criteria:

1. Information needs: reason or need for seeking information including patient care, current awareness, continuing education, and research
2. Information sources: sources from which information is sought or retrieved including colleagues, journals and textbooks, databases, and other electronic resources
3. Frequency of use: frequency with which information is sought or a knowledge source consulted
4. Barriers to use: barriers to seeking or acquiring information such as lack of time, inadequate access, lack of skills, costs, and isolation

Only those studies that meet all of the selection criteria and at least one of the evaluative criteria are included in the review. The eligible studies are listed by year of publication in Table 1. The table charts the authors, methodologies, and subjects or settings of the studies. Bibliographic information for the studies is found in Table 2; citations in the text refer to these lettered references. A number of the studies that look at rural health practitioners' information needs are the result of library outreach projects to these groups. National Library of Medicine and National Network of Libraries of Medicine funding for these outreach activities may contribute to the high number of American studies in this review. The studies use different methods; many have small populations; and many are heavily based on physician populations. It is not possible to combine the data from these studies, but it is possible to document what has been learned about the information needs of rural health professionals using a systematic method based on common criteria.

RESULTS

Information needs

Nine of the articles in this review discussed the information needs of rural health professionals. Patient care

Table 1
Chronology of studies

Year	Author	Method	Subjects/Setting
1978	Strasser	Questionnaire	Northeastern New York state physicians
1980	Stinson/Mueller	Interviews	402 random Alabama health professionals
1984	Moore-West et al.	Critical incident technique	497 random New Mexico physicians
1986	Hulkonen/Mack	Likert scale questionnaire	All South Dakota physicians
1989	Marshall	Questionnaire	150 Canadian health care professionals
1992	Ely et al.	Observation	30 Missouri family physicians
1993	Dee/Blazek	Observation and interview	12 rural Florida physicians
1993	Dorsch/Landwirth	Questionnaire	100 health professionals at 8 rural Illinois hospitals
1994	Lundeen et al.	Semi-structured interview and questionnaire	Hawaiian health care professionals
1994	Pifalo	Questionnaire	Health care professionals at 2 rural Illinois hospitals
1994	Dorsch/Landwirth	Document requests analysis	Document requests generated by rural health professionals
1994	Robishaw/Roth	Questionnaire	Central Pennsylvania physicians
1994	Bowden et al.	Mailed questionnaire	Physicians in 5 Texas counties
1995	Christensen et al.	Survey and focus group	Health care professionals in rural Utah community
1995	Dorsch/Pifalo	Follow-up questionnaire	Health professionals from 3 Illinois outreach projects
1996	Shelstad/Clevenger	Questionnaire	New Mexico general surgeons
1996	Forti et al.	Mailed survery	39 rural Pennsylvania counties/family physicians
1996	Burnham/Perry	Questionnaire	Health professionals in South Alabama rural outreach project
1997	Dorsch	Questionnaire	Health professionals in Illinois follow-up project
1997	Dorsch/Pifalo	Document requests analysis	Document requests from 3 Illinois outreach projects
1997	Farmer/Richardson	Survey	41 nurses in remote Western Isles of Scotland
1997	Wood et al.	Survey	2,500 randomly selected NLM database users
1998	D'Alessandro et al.	Survey and modified critical incident technique	Physicians in 6 rural Iowa hospitals
1999	Chimoskey/Norris	Survey	350 rural generalist physicians in Washington
1999	Short	Survey	131 eastern Washington rural family physicians

emerged as the primary reason for seeking information. These studies reported ranges between 27.9% to 79% for the need for patient-care information; therapy questions occurred most frequently. Some of the studies focused specifically on answering clinical questions encountered during patient care. Although patient care was seen as the most important reason for questions by both rural and urban physicians, the study by Moore-West [R] reported that physicians from urban areas had enough variation in the reasons, such as research, for seeking information as to result in a statistically significant difference between them and groups from medium and small communities. Robishaw and Roth's [T] findings indicated 77.3% of rural Pennsylvania physicians reported using MEDLINE for patient-care reasons. Bowden's [A] study of physician needs in Texas suggested different reasons for using MEDLINE when comparing physicians from four rural counties with physicians in a county with an academic health sciences library. In Bowden's study, fewer rural physicians gave patient care as a reason for seeking information (27.9%) than did urban physicians, however, both groups ranked the top-three patient care reasons as: (1) treatment, (2) diagnosis, and (3) drug information.

Dee and Blazek [F] learned, through chart review and interviews that 75% of patient care questions were for treatment, 14.7% for diagnosis, 8.3% for etiology, and 2.1% for psychological queries. A questionnaire by Dorsch and Landwirth [H] found similar percentages for type of information needs: 72% therapy, 12% diagnosis, and 7% prognosis. Ely [L] observed that drug-prescribing questions were the most common; questions pertaining to treatment accounted for thirty of the forty-one questions posed by family physicians while seeing patients during this study. Christensen [D] found that dentists, orthodontists, optometrists, and pharmacists ranked drug information first, followed by the need to know about new medical techniques and advances.

A different method of information-needs assessment was utilized in an analysis of documents delivered to rural health professionals in a Grateful Med outreach project. The study by Dorsch and Landwirth [H] showed a strong need for clinical information with 68.8% of requests for clinical titles. Dorsch and Pifalo [J] conducted a follow-up to this study, which included data from additional outreach projects, and found 79% of requested documents were clinical in nature with other titles from administration, preclinical sciences, and social sciences.

Preferences for information sources

Fifteen of the papers in this review studied the sources health professionals used to acquire information. Like their urban counterparts, rural health professionals ranked colleagues as a preferred information source. Responses to a survey by Stinson and Mueller [W] in 1980 of randomly selected Alabama health profession-

Table 2
Literature review

A. Bowden VM, Kromer ME, Tobia RC. Assessment of physicians' information needs in five Texas counties. Bull Med Libr Assoc 1994 Apr;82(2):189–96.
B. Burnham JF, Perry M. Promotion of health information access via Grateful Med and Loansome Doc: why isn't it working? Bull Med Libr Assoc 1996 Oct;84(4):498–506.
C. Chimoskey SJ, Norris TE. Use of MEDLINE by rural physicians in Washington state. J Am Med Infor Assoc 1999 Jul/Aug;6(4):332–3.
D. Christensen SB, Broadway MD, Garbutt H. Medical information needs and frustrations in a rural community. Rural Libraries 1995;15(2):55–72.
E. D'Alessandro DM, D'Alessandro MP, Galvin JR, Kash JB, Wakefield DS, Erkonen WE. Barriers to rural physician use of a digital health sciences library. Bull Med Libr Assoc 1998 Oct;86(4):583–93.
F. Dee C, Blazek R. Information needs of the rural physician: a descriptive study. Bull Med Libr Assoc 1993 Jul;81(3):259–64.
G. Dorsch JL, Landwirth TK. Rural Grateful Med outreach: project results, impact, and future needs. Bull Med Libr Assoc 1993 Oct;81(4):377–82.
H. Dorsch JL, Landwirth TK. Document needs in a rural Grateful Med outreach project. Bull Med Libr Assoc 1994 Oct;82(4):357–62.
I. Dorsch JL. Equalizing rural health professionals' information access: lessons from a follow-up outreach project. Bull Med Libr Assoc 1997 Jan;85(1):39–47.
J. Dorsch JL, Pifalo V. Rural health professionals and information access: a follow-up study. In: Lacroix EM, ed. Health information for the global village. Washington, DC: Local Organizing Committee, 7th International Congress on Medical Librarianship, 1995:6–10.
K. Dorsch JL, Pifalo V. Information needs of rural health professionals: a retrospective use study. Bull Med Libr Assoc 1997 Oct;85(4):341–7.
L. Ely JW, Burch RJ, Vinson DC. The information needs of family physicians: case-specific clinical questions. J Fam Pract 1992 Sep;35(3):265–9.
M. Farmer J, Richardson A. Information for trained nurses in remote areas: do electronically networked resources provide an answer? Health Libr Rev 1997;14(2):97–103.
N. Forti EM, Martin KE, Jones RL, Herman JM. An assessment of practice support and continuing medical education needs of rural Pennsylvania family physicians. J Rural Health 1996 Fall;12(5):432–7.
O. Hulkonen DA, Mack BR. Physicians' perceptions of library services in a rural state. Bull Med Libr Assoc 1986 Jul;74(3):205–9.
P. Lundeen GW, Tenopir C, Wermager P. Information needs of rural health care practitioners in Hawaii. Bull Med Libr Assoc 1994 Apr;82(2):197–205.
Q. Marshall JG. Characteristics of early adopters of end-user online searching in the health professions. Bull Med Libr Assoc 1989 Jan;77(1):48–55.
R. Moore-West M, Northup D, Skipper B, Teaf D. Information-seeking behavior among physicians practicing in urban and nonurban areas. In: Proceedings of the 23d Annual Conference on Research in Medical Education, Association of American Medical Colleges, 1984:237–42.
S. Pifalo V. Outreach to health professionals in a rural area. Med Ref Serv Q 1994 Fall;13(3):19–26.
T. Robishaw SM, Roth BG. Grateful Med-Loansome Doc outreach project in central Pennsylvania. Bull Med Libr Assoc 1994 Apr;82(2):206–13.
U. Shelstad KR, Clevenger FW. Information retrieval patterns and needs among practicing general surgeons: a statewide experience. Bull Med Libr Assoc 1996 Oct;84(4):490–7.
V. Short MW. CD-ROM use by rural physicians. Bull Med Libr Assoc 1999 Apr;87(2):206–10.
W. Stinson ER, Mueller DA. Survey of health professionals' information habits and needs conducted through personal interviews. JAMA 1980 Jan 11;243(2):140–3.
X. Strasser TC. The information needs of practicing physicians in northeastern New York State. Bull Med Libr Assoc 1978 Apr;66(2):200–9.
Y. Wood FB, Wallingford KT, Siegel ER. Transitioning to the Internet: results of a National Library of Medicine user survey. Bull Med Libr Assoc 1997 Oct;85(4):331–40.

als indicated regular use of colleagues. A 1984 critical incident random survey of New Mexico physicians by Moore-West [R] documented that rural physicians ranked colleagues as their first information choice, whereas urban physicians chose journal articles first. A 1996 New Mexico study by Shelstad [U], however, found more urban surgeons relied on colleagues (95%) than rural surgeons (88%), perhaps due to distance. Studies by Ely [L], Dee [F], and Christensen [D] all confirmed that health professionals ranked colleagues first as a preferred source of information. Hulkonen's [O] study demonstrated regular reliance on colleagues by three groups of physicians divided in proportion to the extent of access to library services: served, underserved, and unserved. The biggest difference in the groups came in MEDLINE use, with the unserved group reporting lower perceived ability to access MEDLINE.

In the earliest study in this review, Strasser [X] examined the use of selected information sources among a broadly based population (28% rural) of practicing physicians in a designated Health Shortage Area in upstate New York. She found a correlation with involvement in academic medicine (research or education) and found a statistical relationship in every case except in use of colleagues as a source of information. Whereas use of MEDLINE was noticeably greater among researchers (69%) and teachers (47%) compared to all respondents (27%), no statistical difference was found in the use of colleagues across academic and nonacademic lines.

The medical literature emerged as another common preference in the studies although expressed in a variety of ways: use of personal collections and libraries, journals and textbooks, and MEDLINE searching. In the studies by Lundeen [P], Bowden [A], and Burnham [B], the medical literature ranked first as the preferred source of information. Moore-West [R] recorded that both urban and rural physicians ranked personal libraries as the first recourse for information although rural physicians were more likely to use textbooks, while urban physicians were more likely to use journals. Journals and books were found to be used with high frequency in the 1980 study by Stinson [W] and the 1996 study by Shelstad [U]. However, observation studies by Ely [L] in 1992 and Dee [F] in 1993 dropped personal textbooks and journal subscriptions to the third and fourth positions, respectively, and recorded little use of the library even when one was available and almost no use of computers. Pifalo's [S] survey of rural health professionals confirmed other studies that ranked personal libraries and colleagues as the most frequently used sources of information. As late as 1999, a study by Chimoskey and Norris [C] showed continued reliance on colleagues (93%), reference texts (93%), and journal articles (96%) as favored sources of information.

The findings of self-report studies varied in the extent to which health professionals used library resources or MEDLINE. Self-report studies relied on the recollections or perceptions of the respondents, which

might account for the variation in results. In a 1996 Pennsylvania study by Forti [N], 68% of respondents reported making use of either a local library or the National Library of Medicine. This study reported 28.3% of study participants used computers to access medical information. An important note was that 49.3% said they would use library resource systems, if they were available to them, and 47% said they would make use of online database search assistance, if it were available. A self-report study by Bowden [A] showed that 44.6% of rural physicians had never done their own MEDLINE search; 44% of rural surgeons in the Shelstad [U] study reported having requested librarian performed literature searches; and a follow-up study of two Illinois Grateful Med projects by Dorsch and Pifalo [J] showed that 42% of the respondents had searched Grateful Med since the completion of the projects.

The use of electronic information resources did not change dramatically between the early and late studies in the 1990s. Two 1999 studies, both conducted to measure use of electronic resources by rural Washington state physicians, showed similar percentages for MEDLINE use and online searching as did earlier studies. Chimoskey and Norris [C] reported that 40% of the queried physicians used MEDLINE. Short's [V] study, focusing specifically on CD-ROM use, showed that 25.6% of CD-ROM use was for literature searching, 44.9% for medical texts, and 52.6% for entertainment.

Frequency of information use

Ten of the studies in this review measured the frequency and extent of use of information resources by rural health professionals. The results indicated that rural health care practitioners used information sources less frequently than their urban counterparts. In Strasser's [X] 1978 study, rural physicians in private practice, in most instances, used printed sources with less than average frequency and were somewhat more involved with sales representatives when compared to their urban counterparts. Stinson's [W] 1980 study found rural practitioners used journals less frequently than urban practitioners, adding that 83% of the rural practitioners did not even have access to *Index Medicus*. Moore-West's [R] 1984 study also found a low journal-use pattern among physicians in nonurban areas.

Lundeen's [P] study of rural Hawaiian health professionals in 1994 indicated little use of online systems or interlibrary loan suggesting journal use restricted to personal subscriptions. Lundeen's study also pointed out that journal use could be for continuing education and general browsing in addition to a systematic search to answer a specific case question. Further, the study found differences in information use among health professional groups, with physicians reporting the most use of journal articles (51%), followed by nurses (36.8%), administrators (36.1%), allied health personnel (27.5%), and social workers (26.7%). In the same year, Bowden's [A] study found that 52.2% of rural physicians reported never having used MEDLINE, compared with only 10.1% of urban physicians claiming no MEDLINE use. In Farmer's and Richardson's [M] survey of nurses in the remote Western Isles of Scotland, only 8% responded they had used MEDLINE, the Cumulative Index to Nursing and Allied Health Literature (CINAHL), or the Cochrane Database within the previous six-month period.

Marshall's [Q] study, using the diffusion of innovation theory, examined the characteristics of early adopters of end-user online literature searching and found defined demographic associations in implementation levels. Positive correlations were more likely to fit an urban practice profile. Marshall concluded that the typical user was computer literate, placed a high value on formal information sources, was located in an urban center, was in group practice, had access to a library and system training, and spent at least some time in research. Negative associations of those least likely to adopt online searching were small community size, solo practice, and large percentage of time spent in patient care. General practitioners and family physicians had lower implementation levels than physicians in other specialties. The same observation about solo practice had been made by Stinson in 1980, who noted that solo practitioners used the library less than did physicians in group practice [W].

Ely [L] observed that rural family practitioners raised fewer questions per patient (1/24) than urban family practitioners (1/9), even though the difference between the number of patients seen per hour by the two groups was not statistically significant. Demographic differences between the two groups were significant, however. Rural physicians were an average forty-six years old with seventeen years experience, compared to an average thirty-eight years of age with nine years experience for the urban physicians. Practice differences also existed, with rural practice groups averaging 1.4 physicians compared to 2.6 physicians in urban groups.

Hulkonen [O] found only one variable provided significant differences in group responses and that was whether physicians were unserved or underserved versus groups served by library information services. In general, the unserved and underserved physicians demonstrated less knowledge of local, state, and regional library services and used MEDLINE and interlibrary loan infrequently. The two groups in Bowden's [A] Texas study were compared primarily to determine differences between physicians who had access to established medical libraries and physicians who practiced in remote areas without local access to medical information. The results indicated that differences

Table 3
Demographic and geographic factors associated with less use of information

No access to local library services	Hulkonen	1986
	Bowden	1994
Small community size	Marshall	1989
	Short	1999
Rural location	Ely	1992
Solo practice	Stinson	1980
	Marshall	1989
Small group practice size	Ely	1992
Large % of time spent on patient care	Marshall	1989
General practice	Marshall	1989
Older age of practitioner	Ely	1992
Greater number of years in practice	Short	1999

in the profiles did not affect information use but that differences did exist between the two groups in the use of MEDLINE and libraries.

Demographic differences were also significant in Short's [V] study, which charted an inverse relationship between computer ownership and number of years in practice. Of physicians in practice for less than ten years, 80.6% owned computers with CD-ROMs, whereas among those physicians in practice for more than thirty years, the percentage was only 32.4%. Table 3 outlines the demographic and geographic factors in information use from these studies.

Barriers

Several barriers are consistently apparent from 1975 to 1999 from the reviewed studies: lack of time, isolation, lack of library, technology illiteracy, lack of equipment, and cost. Although many of these barriers are shared by urban health professionals, they appear to be more prominent among rural health professionals. Fourteen of the studies in this review document barriers to acquiring and using information.

Dee's [F] study cited lack of time as the major obstacle to consulting books and journals or using the library to answer clinical questions. Lack of time was also the major barrier reported by 65% of respondents in the Illinois follow-up study by Dorsch and Pifalo [J] and by 30.1% of respondents in Forti's [N] study in 1996. Bowden's [A] Texas study showed 22.8% of rural versus 14.3% of urban health professionals reported lack of time as the major obstacle to seeking information.

Lundeen [P], Burnham [B], and Shelstad [U] all found that isolation was a major barrier to rural health professionals' use of information. Isolation implies geographic isolation, lack of access to a medical school or academic health sciences library, distance from specialist colleagues, and inadequate road and telecommunications infrastructures. Remoteness from the Western Isles hospital library, lack of local information, and general lack of awareness of available information were the most common problems reported by nurses in the needs assessment by Farmer and Richardson [M].

Lack of a local library (collections, staff, services) was another significant barrier reported by Shelstad [U] and Burnham [B]. Reliance on an information intermediary was clearly demonstrated in the 1995 Dorsch and Pifalo [J] study, which found that 82% of Urbana project document requests coincided with circuit librarian visits, and that 93% of the Peoria project requests came from hospitals with project-trained intermediaries acting on behalf of other health professionals. In Dorsch's follow-up outreach project, project participants and liaisons alike reported that lack of an onsite library was a major barrier to acquiring information (I).

Even in more recent studies, lack of equipment was listed as a barrier. In a 1995 Illinois study by Dorsch and Pifalo [J], 26% of respondents said lack of computer equipment was a reason for not using medical databases. In Forti's [N] 1996 survey, 18.4% reported lack of equipment as a barrier. Although 86% of the physicians had office computers, only 62% had modems, and only 28% used them to access medical information. A 1999 Washington survey by Chimoskey [C] recorded computer ownership at 88%.

A National Library of Medicine (NLM) [Y] survey of Internet access conducted in 1995 discovered significant differences in geographic location among NLM database users. A random survey of 2,500 NLM users found that almost half of the respondents (46%) were identified as searching from a location inside a city center and only 12% from a rural location. The only variable identified as a significant factor in this difference was Internet access; overall, 24% of urban customers did not have Internet access compared to 36% of rural customers.

Lack of technological skills appeared to be another significant barrier for rural health professionals. Lack of skills, either computer or searching, was reported by 61% of respondents in the Illinois follow-up study by Dorsch and Pifalo [J], by 32% in the Shelstad [U] study of surgeons in New Mexico, and 19% in Burnham's [B] study (expressed as needing more training). Computer illiteracy is cited as a barrier by 7.9% of the rural family physicians in Forti's [N] 1996 study.

Forty-nine percent of health professionals in Lundeen's [P] study of administrators, nurses, physicians, social workers, pharmacists, and others cited cost as a barrier to filling information needs. Of Forti's [N] rural family physician respondents, 14.7% cited cost as a barrier.

Barriers were reported in different categories by D'Alessandro et al. [E] in a 1998 study of barriers to rural physicians' use of a digital health sciences library. The greatest barriers were personal (45%) expressed by such feelings as not having enough train-

ing, being too time consuming, and having an aversion to computers. Accessibility barriers were next (21%) with inconvenient location of the computer being the most common. Resource barriers were the least common (9%) with not enough information and information credibility being the highest in this category.

DISCUSSION

The studies in this review used similar methodologies, but differences in populations, sample sizes, and survey questions made it difficult to systematically combine and statistically analyze the results of the studies. However, the studies were similar enough to draw conclusions from some common themes that emerged from the results.

Questionnaire or survey was the most commonly used method in these information-needs studies. Although self-report studies were limited by recall of perceived information needs and use, the advantage of this methodology was ease of obtaining results from a large population. Two of the studies [F, L] relied on observation, providing insight into actual information needs and use in practice. The disadvantage to these studies was the time intensity and intrusiveness of the work, which limited them to small populations. Two studies [H, K] analyzed documents requested by rural health professionals as indicators of actual information needs.

The information needs of rural health professionals did not seem to vary greatly from the needs of other primary care practitioners; rather, differences in information needs seemed to depend more on type of practice. Most rural practitioners were in primary care specialties and, thus, most of their information needs, like those of other primary care specialists, were centered on patient care. Likewise, the preferences for information sources of rural practitioners matched those of other primary care practitioners. Their preferences corresponded to those found in literature reviews of information use by family physicians [11–13]. These reviews documented that family physicians used colleagues most often as information sources followed by journals and books.

Frequency of use comparisons showed a difference between rural and urban health care professionals and appeared to be tied into both demographic factors and barriers to information use. As a group, rural physicians were older, had been in practice longer, were in solo practice, and practiced in smaller communities than urban physicians. These characteristics matched the profile in Marshall's [Q] study of low computer use, low time spent pursuing clinical questions, and low use of knowledge sources such as MEDLINE.

Although all health professionals experience barriers to information use, the barriers in rural areas are exacerbated by practice patterns, geographic locus, and inequitable access to information resources. The Internet removes some of the isolation barriers and has the potential to facilitate communication between rural health professionals and specialist colleagues at remote centers. However, it remains to be seen if the Internet will be an equalizer in addressing time, cost, training, and access barriers. The Internet will not totally compensate for lack of local library services and, in some ways, may contribute to access problems. The advent of electronic full-text journals may undermine the traditional interlibrary loan cooperation that benefits unserved and underserved health professionals. Many online licensing agreements specifically limit use to affiliates, whereas copies of print journal articles, within copyright guidelines, may be provided to nonaffiliates. Westberg and Miller propose a model in which the academic health center integrates and distributes a wide range of electronic and human resources [14]. This model will require substantial funding for online, full-text journal collections and networked bibliographic databases may be even more expensive than print collections.

Costs associated with acquiring information are more of a burden for rural health professionals than their urban counterparts, because rural health professionals are more likely to have to assume the costs individually than are health professionals at large urban centers with libraries. Marshall notes that health professionals in smaller centers tend not to be among the earliest adopters of an innovation in information technology that could be of particular benefit to them. Marshall [Q] commented in 1989 that the proliferation of databases on CD-ROM at that time might add to the discrepancies, because the cost of subscription for an individual user without library access was high whereas libraries in the larger population centers had more resources to acquire CD-ROM products. Cost remains a barrier even now that select medical resources, notably the National Library of Medicine's PubMed and Internet Grateful Med, are available free of search fees on the Internet. Equipment, access, document delivery, and print and electronic subscription costs, however, have not disappeared.

The time required to search for articles, procure them, and appraise content is another barrier. In an often-cited editorial, ''The Underused Medical Literature,'' Huth states that the medical literature is not a heavily used source of information among practitioners because of its unmanageable size and the heavy cost in time for searching and retrieving papers [15]. Reliance on health information professionals can reduce that burden and can aid the clinician in providing quality patient care. A study by Veenstra [16] demonstrates that a medical librarian added to a teaching service staff is able to find information that affects patient care 40% to 59% of the time. Klein et al. find a correlation between the economic indicators of hospi-

tal costs, charges, and length of stay for inpatient cases with use of MEDLINE. There is a statistically significant reduction in cost and length of stay when MEDLINE searches are conducted by librarians early in the stay [17].

Research about rural outreach projects suggests that information use is much greater when an information professional is available to provide service. Health professionals are also more likely to use information resources if they are familiar with the resource and comfortable with the technology. A study by Northup of clinical information searching behavior of 293 medical students, residents, and physicians concludes that convenience and habit play the most important roles in the choice of resources for information problems. Northup further observes that knowledge of the used resource often comes from working relationships or from education experiences [18]. Northup's conclusion seems to be as true today as it was in 1983, based on the studies in this review that point to isolation from libraries as a major barrier to learning about, accessing, and utilizing information.

CONCLUSIONS

Rural health practitioners appear to have the same basic needs for information as urban primary care clinicians. Both groups rely on colleagues followed by personal libraries as their main sources of information. However, rural practitioners tend to use textbooks more than journals, have less access to libraries, make less use of online databases, and ask fewer clinical questions than urban practitioners. The greatest differences, however, seem to exist in the barriers to acquiring information. The studies in this review indicate pronounced information barriers faced by rural practitioners including lack of time, isolation, inadequate library access, lack of equipment, lack of skills, costs, and inadequate Internet infrastructure.

The ultimate goal of health information outreach to rural health professionals is to meet the information needs of these professionals by removing barriers that thwart information-seeking behaviors. The work to equalize access to information has not been completed, but in light of the present electronic environment, there is renewed hope that this will be achieved. In 1997, Wood et al. [Y] emphasized the need for NLM to continue the support and expansion of outreach to rural health professionals, saying that efforts to ensure equity of electronic access to electronic information resources, especially for rural and other underserved populations, had not yet been consistently and effectively achieved. Headlines such as ''Rural America Being Left Behind by Digital Divide'' continue to appear as a reminder that this equity has not yet been achieved [19]. Goldberg, of the American Corn Growers Association, citing data from the U.S. Department of Commerce, points out that Americans living in rural areas are lagging behind in Internet access, and that the divide is reaching crisis proportions, particularly when it comes to broad-band access.

Studies to date have identified the information needs, behaviors, and barriers for this group of health professionals. In a five-year summary of outreach efforts, the NLM conceded the difficulties in changing the information-seeking behaviors of health professionals.

> The barriers are multidimensional and range from lack of time to poor telecommunications infrastructure and lack of computers. However, it has also been learned that the process of changing health professionals' information habits is facilitated by repeated contact, including hands-on training, and by the awareness that there is a human resource that can be consulted as questions and problems arise. [20]

This quote highlights the complexity of the task, the multiple barriers, the time- and cost-intensive commitment involved in ongoing training and support, and the need for human contact. Removing barriers to access for rural health professionals requires substantial financial and human support from academic centers, public agencies, private organizations, or partnerships formed among these groups. In addition, continued research focused on understanding information-seeking behaviors of rural health professionals helps create better information tools and services tailored to meet the needs of and to overcome barriers faced by this underserved population.

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